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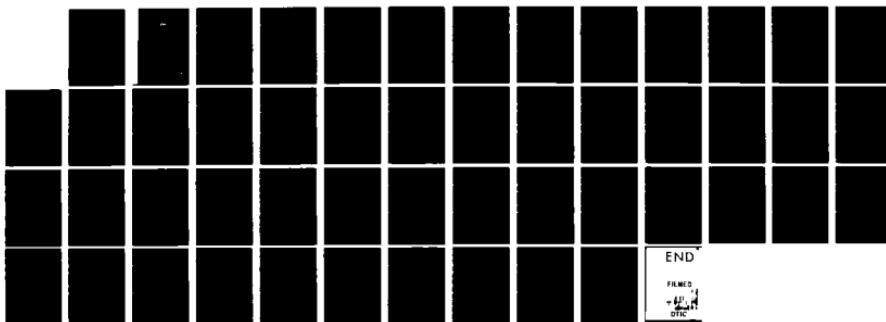
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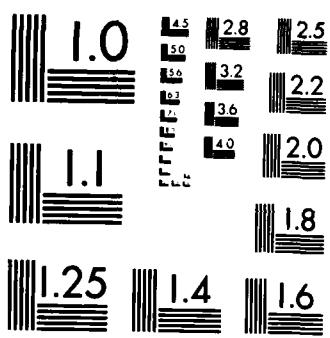
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AFFSE REPORT 1/82

## Laboratory Evaluation of Australian Ration Packs [U]

K. W. JAMES

G. F. THOMSON

C. H. FORBES-EWAN

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ARMED FORCES FOOD SCIENCE ESTABLISHMENT

AFFSE REPORT 1/82

LABORATORY EVALUATION OF  
AUSTRALIAN RATION PACKS (U)

K. W. JAMES  
G. F. THOMSON &  
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SUMMARY

Results of chemical and microbiological analysis of the 1978-79 packaging program are presented. The content of moisture, fat, protein, carbohydrate, thiamin, ascorbic acid and energy of rations are included. Daily available nutrients are estimated and evaluated with respect of daily requirement. Some rations were found to be nutritionally unbalanced with respect to protein content. Certain rations were found to be marginally energy deficient. The rations were found to be microbiologically safe and evidence was found of a decrease in microbiological population during storage of freeze-dried foods. (U)

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16. ABSTRACT:

Results of chemical and microbiological analysis of the 1978-79 packaging program are presented. The contents of moisture, fat, protein, carbohydrate, thiamin, ascorbic acid and energy of rations are included. Daily available nutrients are estimated and evaluated with respect to daily requirements. Some rations were found to be nutritionally unbalanced with respect to protein content. Certain rations were found to be marginally energy deficient. The rations were found to be microbiologically safe and evidence was found of a decrease in microbiological population during storage of freeze dried foods. (U)

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## ABBREVIATIONS

CHO	CARBOHYDRATE
NH&MRC	NATIONAL HEALTH & MEDICAL RESEARCH COUNCIL
CR1M	COMBAT RATION ONE MAN
CR10M	COMBAT RATION TEN MAN
PRPNG	PATROL RATION PAPUA NEW GUINEA
PR1M	PATROL RATION ONE MAN
EFR	EMERGENCY FLYING RATION
ADFFS	AUSTRALIAN DEFENCE FORCE FOOD SPECIFICATIONS

LABORATORY EVALUATION OF  
AUSTRALIAN RATION PACKS (U)

by

K. W. James, G. F. Thomson & C. H. Forbes-Ewan

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*INTRODUCTION*

Previous reports (AFFSE 1970-82) (1-9) have detailed the results of analyses of ration packs from preceding packaging programs. This report details the results obtained by analysis of complete packs for the 1978-79 packaging program.

A sample of each ration component was analysed for moisture, fat, ash, protein, thiamin (vitamin B1), ascorbic acid (vitamin C) and salt. The value for carbohydrate was estimated from the difference between 100 and the sum of the percent content of moisture, fat, ash and protein. Energy values in kilojoules (kilocalorie = 4.186 kilojoules) were calculated from the values recommended by Thomas & Corden (12), Table 1. The rations packaged at the AFFSE were also examined for microbiological quality.

TABLE 1

Energy per Gram of Nutrient

NUTRIENT	kJ/g
Protein	17
Fat	37
Carbohydrate	16
Alcohol	29

*METHODS OF ANALYSIS*

**Chemical:**

The methods of chemical analysis were the same as those used for the analysis of Combat Ration One Man (CRIM) in the previous report (9). Table 2 summarises the results of replicate determinations for each of the methods during analysis of the 1978-89 packaging program.

**TABLE 2**  
**REPLICATE RESULTS CHEMICAL ANALYSIS METHODS**

METHOD	PROCEDURE	Sx	RSD %
Moisture	AOAC 1975 (11) 22.013	0.264%	0.66
Fat	AOAC 1975 (11) 14.019 or 7.045	0.222%	0.888
Ash	AOAC 1975 (11) 14.019 31.012	0.074%	1.48
Protein	AOAC 1980 (18) 7.021	0.088%	0.88
Salt (Chloride)	Auto Potentiometric	0.169%	5.63
Thiamin	AOAC 1975 (11) 43.025	0.016 mg/100g	1.6
Ascorbic Acid	AOAC 1975 (11) 43.051	2.99 mg/100g	5.98
Energy Direct	Bomb Calorimeter	54 kJ/100g	3.63

Sx = Standard Deviation of Paired Values.  
RSD % = Percent Relative Standard Deviation.

Table 3 summarizes the results of recovery trials included during the analysis of the 1978-79 packaging program.

TABLE 3  
RECOVERY RESULTS FOR 1978-79 PROGRAM

DETERMINATION	NUMBER OF RECOVERY TRIALS	MEAN RECOVERY %	STANDARD DEVIATION
Ascorbic acid	25	95.54	6.62
Thiamin	25	98.60	5.61
Protein with Acetanilide	25	99.62	2.17
Lysine		93.33	0.97
Nicotinic Acid		99.77	1.19

**Microbiological:**

Samples of freeze dried products, potato and onion powder and the components of Emergency Flying Rations were tested by the appropriate Australian Standard Methods, within one week of production.

**Standard Plate Count** was conducted using the pour plate method as described in AS 1766 Part 2.1.1 1976.

**Yeasts & Moulds** were enumerated using the pour plate method as described in AS 1766 Part 2.1.2 1976. On occasions malt extract agar was used in place of potato dextrose agar.

**Coliforms & *E. coli*** were enumerated using the pour plate method as described in AS 1766 Part 2.1.3.7 1976. Violet red bile dextrose agar was substituted for desoxycholate agar.

***Staphylococcus aureus*** were enumerated as described in AS 1766 Part 2.1.4.6 1976. A series of dilutions were used so that the Most Probable Number (M.P.N.) technique could be employed.

***Salmonellae*** were enumerated as described in AS 1766 Part 2.1.5 1976.

***Bacillus cereus*** were enumerated by the surface spreading technique as described in AS 1766 Part 2.1.6 1976.

## RESULTS

These evaluations are based on the nutritional requirements stated in the Army Equipment Planning Summary, No 69, Operational Rations and in Weapons and Equipment Policy Statement No 302/4, Operational Rations. These requirements are considered to be equivalent to those of a Reference Man as described by the National Health and Medical Research Council. The reference man is 70 kg and has the requirements for various grades of activity listed in Table 4.

TABLE 4  
NUTRIENT REQUIREMENTS OF REFERENCE 70 KG  
MAN PER DAY

NUTRIENT	REQUIREMENT			
	GRADE 0	GRADE 1	GRADE 2	GRADE 3
Energy kJ	8,400	11,600	13,400	15,800
Protein g	70	70	70	70
Protein 12% energy g		81.2	93.8	110.6
Ascorbic acid (vit C) mg	30	30	30	30
Thiamin (vit B1) mg	1.0	1.16	1.34	1.58
Description of Activity	Maint.	Normal 8 hrs light physical work/day e.g. clerical	Moderate e.g. Infantry	Strenuous e.g. Labouring

Sources: NH & MRC, Dietary Allowance for Use in Australia (10)  
Thomas & Corden (12)

## COMBAT RATION TEN MAN (CR10M)

### Nutritional Evaluation:

The detailed results of chemical analysis of CR10M are listed in Appendix 1.

Table 5 summarises the estimate of nutrients available in each pack when the estimated contribution from supplementary items is added. Comparing the values in table 5 with the nutrient requirement of the reference man (Table 4), it is evident that there is adequate energy for a Grade 1 level of activity in each pack. Pack A exceeds the demand for a grade 2 level of activity by 2600 kJ but packs B, C and D are deficient by 21,700 kJ 17,600 kJ and 3,500 kJ respectively. Each of the packs contains sufficient protein for 14 men for one day at the minimum recommended rate. The thiamin and ascorbic acid content of each menu is greatly in excess of the daily requirement for 10 men, however these levels will decline as the rations age. The salt content is adequate to provide the daily needs including losses due to sweating.

TABLE 5  
COMBAT RATION TEN MAN  
1978-79 PROGRAM  
NUTRIENT CONTENT

	TOTAL MENU WEIGHT g	MOISTURE g	FAT g	ASH g	PROTEIN g	CHO* g	SALT g	THIAMIN mg	ASCORBIC ACID mg	ENERGY kJ
A	15480	8067	1275	625	1182	4331	257	32.46	1837	136600
B	14966	8661	953	603	1029	3720	254	22.52	1707	112300
C	16990	10021	1068	537	1063	4301	283	21.21	2465	126400
D	15381	8244	1186	604	1058	4289	243	25.27	1268	130500

Table 6 summarises the distribution of energy available from the ration packs, including the estimated contribution of supplementary items. The proportion of energy contributed by the protein contained in the rations again exceeds the recommended maximum of 12% in each menu.

\* Carbohydrate

TABLE 6

**COMBAT RATION TEN MAN**  
**1978/79 PROGRAM**  
**PERCENT ENERGY DISTRIBUTION**  
**INCLUDING SUPPLEMENT**

MENU	FAT	PROTEIN	CHO	TOTAL ENERGY kJ
<b>Supplementary</b>				
Items	19.2	11.6	69.1	26,200
A	34.5	14.7	50.8	136,600
B	31.4	15.6	53.0	112,300
C	31.3	14.3	54.4	126,400
D	33.6	13.8	52.6	130,500

**Variation in Components**

All items of CR10M were individually analysed to investigate variation between individual packages of components. Table 7 lists the standard error for those components of which there were at least 4 separate packages. Most components included in the table were received in 8 separate packages, except potatoes which were received in 12 packages. The last two lines of the table list critical values for the standard error at 1% probability level and 5% probability level. These critical values are based on the F statistic using the error of the determinations as shown in Table 2. Standard error values in the table in excess of these critical values can be considered significant variations for that component.

Items containing meat tend to show a wide variation for a number of parameters in Table 7. This is probably due to the relatively large pieces of food in these components, which are more difficult to fill consistently. The variation in net weight is less than 10% of the total net weight in most cases, which is an acceptable variation in fill weight. The variations in the nutrient content are considered acceptable with existing technology and are attributable to the variation in fill weight.

The majority of significant variances in the remaining items arise from weight, moisture, fat and protein. This is probably due to the heterogeneous nature of the foods, which is partly confirmed by the meat containing items. These variances are generally less than 10% of the nominal value and meet general commercial practice.

TABLE 7  
COMBAT RATION TEN MAN  
STANDARD DEVIATION WITHIN ITEMS

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g
Beef & Gravy	5 *	0.55	0.51	0.35 *	1.07 #	1.39	0.29	0.004	0.55	4.2
Potatoes	6 #	1.91 #	0.19	0.12	0.20	1.80	0.148	0.005	1.27	33
Spaghetti & Meat	10 #	1.36 *	0.52	0.25 *	0.87 #	2.13	0.07	0.010	1.83	30
Pork & Cereal	39 #	1.68 #	2.51 #	0.11	0.65 #	1.35	0.07	0.012	0.35	80
Uns. Cond. Milk	6 #	0.89 *	0.47	0.03	0.33 *	1.25	0.007	0.002	7.9	13
Butter Conc.	6 #	0.04	0.89 *	0.50 #	0.20	1.06	0.144	0.013	N/A	18
Tomato Sauce	25 #	1.00 *	0.27	0.13	0.25	0.90	0.11	0.051	9.5	12
Vegetime	6 #	3.25 #	0.20	0.38 *	1.17 #	3.27	0.28	0.99	33.4 #	51
Instant Coffee	1.3	1.39 *	0.51	0.41 *	0.49 *	1.93	0.013	0.133 #	85 #	N/A
Fruit Pudding	35 #	0.18	0.85 *	0.06	0.13	0.78	0.0091	0.009	1.7	20
Beef Steak & Kidney	3	2.53 #	1.15 *	0.15	1.33 #	1.79	0.075	0.023	1.2	59
Beef & Beans	9 #	0.99 *	0.93 *	0.18	0.44 *	1.63	0.098	0.003	1.8	15
Luncheon Meat	3	0.70	0.83 *	0.14	0.39 *	0.97	0.13	0.004	1.9	24
Fruit Salad	1	0.71	N/A	0.02	0.06	0.72	N/A	N/A	0.1	11
Sliced Peaches	8 #	0.27	0.04	0.07	0.02	0.34	0.001	N/A	0.3	4
Beef & Vegetable Curry	6 #	1.45 *	0.86 *	0.25 *	0.61 #	1.06	0.228	0.007	1.8	31
Beef with Tomato Puree	6 #	0.66	1.94 #	0.23	1.28 #	0.90	0.105	0.005	1.3	46
Corned Beef Loaf	2	1.54 #	1.67 #	0.03	7.41 #	6.33	0.029	0.001	0.2	54
Luncheon Meat	0	0.66	0.46	0.05	0.41 *	0.64	0.144	0.004	0.7	11
Sx for F $\alpha = 1\%$	5.85	1.54	1.39	0.43	0.51	—	0.99	0.094	17.5	315
Sx for F $\alpha = 5\%$	3.32	0.88	0.74	0.25	0.29	—	0.56	0.053	9.9	179

c These results are derived from moisture, fat, ash and protein and represent the combined error of these values.

N/A NOT AVAILABLE

# Significant standard error at 1% level.  
\* Significant standard error at 5% level.

**COMBAT RATION ONE MAN**  
**(CR1M)**

The detailed results of chemical analysis of CR1M are listed in Appendix 2.

Table 8 summarises the estimate of nutrients available in each pack. The energy available in each of the packs is adequate to sustain a reference 70 kg man at a grade 2 level of activity for one day. Packs A, C and E contain nearly sufficient energy to sustain a grade 3 level of activity. The protein level in each of the packs is satisfactory, but pack B is only marginally above the minimum recommended daily intake of 70 g. The thiamin and ascorbic acid levels are greatly in excess of daily needs. The packs can be expected to retain sufficient of these vitamins for at least 2 years, depending on storage conditions. The salt content is considered adequate for the varied conditions of use and in particular, to replace losses due to sweating.

Table 9 summarises the distribution of energy available in CR1M. The proportion of energy available from fat in pack E is considered excessive and should be reduced.

**TABLE 8**  
**COMBAT RATION ONE MAN**  
**NUTRIENT CONTENT**

MENU	TOTAL WEIGHT g	MOISTURE g	FAT g	ASH g	PROTEIN g	CHO g	SALT g	THIAMIN mg	ASCORBIC ACID mg	ENERGY CALC kJ
Common Items	567	21.8	96.6	10.8	38.9	399.1	6.5	3.60	118.3	10600
A	1144	368.0	147.8	19.9	91.2	517.2	12.7	3.82	138.6	15300
B	1140	401.3	121.2	21.1	71.3	525.3	14.1	4.03	168.6	14100
C	1149	368.9	154.2	19.2	103.4	503.9	11.5	3.70	133.5	15500
D	1135	385.1	141.7	24.4	86.5	497.6	15.5	3.86	184.9	14700
E	1127	361.4	166.2	22.9	89.4	487.3	15.9	3.80	177.9	15500

**TABLE 9**  
**COMBAT RATION ONE MAN**  
**PERCENT ENERGY DISTRIBUTION**

MENU	FAT	PROTEIN	CHC	TOTAL ENERGY kJ
Common Items	33.7	6.2	60.1	10600
A	35.8	10.1	54.1	15300
B	31.8	8.6	59.6	14100
C	36.8	11.3	51.9	15500
D	35.7	10.0	54.3	14700
E	39.8	9.8	50.4	15500

## PATROL RATION PAPUA NEW GUINEA (PRPNG)

The detailed results of chemical analysis for PRPNG are listed in Appendix 3.

Table 10 summarises the estimate of nutrients available in each pack. There is a deficiency of 1900 to 2600 kJ of energy in each of the packs for a grade 2 level of activity. However, these packs are designed to be used by soldiers who also forage for additional food. The protein content is adequate for one man. The thiamin and ascorbic acid contents exceed the recommended daily requirement, and are likely to remain adequate for a long period of storage. The salt content could be considered excessive, but will replace large losses due to sweating in a tropical climate.

Table 11 summarises the distribution of energy available from the rations. The proportion available from protein in packs A, C, and D is marginally excessive, but is likely to be offset by the energy derived from the plant foods obtained by foraging.

TABLE 10  
**PATROL RATION PAPUA NEW GUINEA  
 1978/79 PROGRAM**  
**NUTRIENT CONTENT**

MENU	TOTAL WEIGHT g	MOISTURE g	FAT g	ASH g	PROTEIN g	CHO g	SALT g	THIAMIN mg	ASCORBIC ACID mg	ENERGY kJ	Calc. Dir.
Minor Components	92.5	—	—	—	—	83.4	7.1				
	907	286.2	60.0	25.9	79.0	456.4	15.3	24.0	89.6	10800	11700
	864	259.3	87.7	22.8	78.7	416.0	14.9	29.7	195.7	11200	11600
	853	243.9	96.2	21.2	91.3	400.9	15.3	36.1	159.8	11500	11400
D	910	271.9	64.8	22.0	85.3	466.4	14.5	38.3	182.5	11300	11300

**TABLE 11**  
**PATROL RATION PAPUA NEW GUINEA**  
**1978/79 PROGRAM**  
**PERCENT ENERGY DISTRIBUTION**

MENU	FAT	PROTEIN	CHO	TOTAL ENERGY kJ
A	20.4	12.4	67.2	10500
B	28.9	11.9	59.2	11200
C	30.9	13.5	55.7	11500
D	21.2	12.8	66.0	11300

## PATROL RATION ONE MAN (PR1M)

### Nutritional Evaluation:

The detailed results of chemical analysis for PR1M are listed in Appendix 4.

Table 12 summarises the estimate of nutrients available in each pack. There is an energy deficiency for grade 2 level of activity of 1200 to 1600 kJ. This energy deficiency can be rectified by foraging, or by supplementing the ration with one to three chocolate rations. The protein content of each of the rations is sufficient to meet the requirements of two men per day. If this quantity of protein is consumed by one man in a day it is likely to generate a demand for an additional 0.35 to 0.43 L of water, which is required for the excretion of protein metabolites. The thiamin and ascorbic acid contents are adequate, and are likely to remain adequate for a long period of storage, depending on conditions. The salt content could be considered excessive but would be necessary to replace large losses due to sweating.

Table 13 summarises the distribution of energy available from the rations. The proportion available from protein greatly exceeds the recommended maximum of 12%. This imbalance could be redressed by using the ration over two days with the aid of a large carbohydrate rich supplement, such as fruits obtained by foraging.

### Microbiological Evaluation:

Appendix 5 summarises the results of monitoring PR1M component production at AFFSE. The rejected batches exceeded microbiological specifications and were not included in rations for issue. Potato and Onion powder throughout the production period gave rise to borderline failure due to microbiological specifications for standard plate count. All the potato powders available in Australia characteristically give this problem and the powder used was the best available. Research is currently being directed towards obtaining a more satisfactory microbial quality, while retaining palatable rehydrated powder. The distributions of Standard Plate Count for the other products are generally skewed towards the lower counts because of quality control measures.

TABLE 12

PATROL RATION ONE MAN  
1978/79 PROGRAM  
NUTRIENT CONTENT

MENU	TOTAL WEIGHT g	MOISTURE g	FAT g	ASH g	PROTEIN g	CHO g	SALT g	THIAMIN mg	ASCORBIC ACID mg	Calc. mg	ENERGY kJ	
											Dir.	12500
A	679	37.7	106.8	28.5	158.9	347.1	15.7	4.15	144.5	12200		
B	679	35.0	97.1	29.3	175.9	341.7	17.5	6.4	146.2	12100		11000
C	686	36.3	82.7	31.3	143.1	392.5	19.4	3.32	154.4	11800		11000

TABLE 13

PATROL RATION ONE MAN  
1978/79 PROGRAM  
PERCENT ENERGY DISTRIBUTION

MENU	FAT	PROTEIN	CHO	TOTAL ENERGY kJ
A	32.4	22.1	45.5	12200
B	29.8	24.8	45.4	12100
C	26.1	20.6	53.3	11800

#### **Effect of Storage on Microbial Population:**

Many of the components of the PR1M were subjected to a two year storage trial to test the theory of Pablo, Sinskey and Silverman (1967) that the microbial population of freeze-dried foods will decline in storage. Table 14 shows the results of the trial.

Each of the freeze-dried components show a significant reduction of microbial population at the 5% level, and most are significant at the 1% level. None of the specific organisms counted had significant populations during initial enumeration, therefore, it is not possible to consider any changes in distribution of the organisms within the populations.

Potato and Onion powder is a blend of hot air dried components. It does also show a significantly lower total microbial population and a lower *B. cereus* population after two years storage. The higher population of yeasts and moulds enumerated after two years storage may be attributed to the methods of enumeration. The yeast and mould population was counted on media after two years different from that used for the initial counts. Other trials to test the efficiency of these media show that the number obtained on the media used for initial counts are consistently lower than those obtained on the media used for the two year storage counts. Therefore, the negative t statistic for yeasts and moulds cannot necessarily be regarded as evidence of yeast and mould growth during storage in potato and onion powder.

**TABLE 14**  
**PATROL RATION ONE MAN**  
**2 YEAR STORAGE TRIAL 1978/79 PROGRAM**

PRODUCT	PARAMETER	LOG <sub>10</sub> Initial Count	LOG <sub>10</sub> 2 year count	t stat	t <sub>t</sub>
Beef & Green Beans	S.P.C.	2.347	2.102	2.01	1.64* 2.33#
Beef & Onions	S.P.C.	1.931	1.634	1.85	1.67* 2.39#
Lamb & Veg Curry	S.P.C.	3.124	2.746	4.29	1.67* 2.39#
Potato & Onion	S.P.C.	3.810	3.573	3.95	
	Y & M	.723	1.011	-5.25	
	B.C.	2.743	2.183	7.09	1.67* 2.39#
Roast Pork & Gravy	S.P.C.	2.628	2.157	3.24	1.67* 2.39#
Rice	S.P.C.	1.032	0.106	8.22	1.67* 2.39#
Savoury Steak Fingers	S.P.C.	2.616	2.055	4.84	1.67* 2.39#
Spaghetti	S.P.C.	2.346	0.845	3.20	1.75* 2.60#
Sweet & Sour Pork	S.P.C.	2.210	1.658	1.77	1.68* 2.42#

\*  $\alpha$  = 0.05                                   #  $\alpha$  = 0.01

S.P.C. = Standard Plate Count

Y & M = Yeasts and Moulds

B.C. = *Bacillus cereus*

## EMERGENCY FLYING RATION (EFR)

### Nutritional Evaluation

The detailed results for chemical analysis of EFR components are listed in Appendix 6.

Table 15 summarizes the nutrients available in two separate packs. The energy content is adequate to supply at least basal needs for a day. The protein content is sufficient to meet the daily requirement of a man. The pack is intended to improve morale in an emergency rather than meet a specific nutritional requirement. However, the thiamin content is sufficient to meet daily requirements for up to 10 days, while ascorbic acid content is sufficient to meet daily requirements for eight to ten days. The salt content is adequate to replace losses due to sweating.

Table 16 summarizes the variation in thiamin and ascorbic acid concentration for certain fortified EFR components. The results show that there can be a wide variation in concentration for both thiamin and ascorbic acid. In serious cases it can be as high as 40 to 50% of the mean concentration. Therefore, it is possible for a pack to initially contain only sufficient vitamins for six days or sufficient for fourteen days.

Table 17 summarizes the distribution of energy available from the ration. The proportion available from protein is marginally high, but this is not considered serious as the user is not expected to be sustained for long periods by the ration.

AFFSE report 2/81 (17) recommends a number of changes to the EFR. Many of these changes were implemented in the packaging program for 1981. The recommendation to replace milk powder with condensed milk was not implemented as condensed milk does not retain its quality during long term storage. Other types of milk products are being investigated for their suitability. One third of the coffee has been replaced with a tea bag; but the tea is not fortified and will therefore lead to a reduction in thiamin (0.09 mg) and ascorbic acid (35 mg) content. The beef block has been flavoured by the addition of beef booster flavour or a savoury sauce flavour, which will marginally increase the salt content. None of these changes are expected to significantly alter the nutritional quality of the EFR.

### Microbiological Evaluation

Appendix 7 summarises the distribution of the microbial population in the components of the EFR. All components meet the relevant specification (16) and fall within a narrow range of counts.

### Vitamin Content After Storage

Table 18 shows the percentage of the vitamins, thiamin and ascorbic acid retained by fortified EFR components after 2 years storage at 37°C. These results indicate that after this period the ration will still contain sufficient thiamin (2.4 mg) to sustain a man for 2 days, and sufficient ascorbic acid (211 mg) for 7 days.

Figure 1 illustrates the progressive decline in the thiamin concentration of instant coffee at three storage temperatures. Similar graphs can be expected for the other fortified components.

The above results show that there is still adequate vitamin content in the ration after two years. They also suggest that it may be possible to extend the life of the rations beyond two years. Research is continuing to define the life of this ration.

TABLE 15  
EMERGENCY FLYING RATION  
1978/79 PROGRAM  
NUTRIENT CONTENT

Menu	Total Weight g	Moisture g	Fat g	Ash g	Protein g	CHO g	Salt g	Thiamin mg	Ascorbic Acid mg	Energy kJ
A	714	46.7	108.7	37.3	93.3	428.0	28.4	11.0	246.5	12500
B	717	45.9	104.5	38.0	93.1	435.5	26.1	11.3	299.0	12400

TABLE 16  
EMERGENCY FLYING RATION  
1978/79 PROGRAM  
VARIATION OF VITAMIN CONTENT  
FORTIFIED ITEMS  
mg/100g

EFR COMPONENT	PRODUCTION YEAR	THIAMIN		ASCORBIC ACID	
		$\bar{x}$	$2\sigma$	$\bar{x}$	$2\sigma$
Instant Coffee	1981	9.68	4.04	1156	554
Chocolate	1978/79	5.94	2.88	15.9	8.7
	1981	4.34	.61	30	3.2
Cheers	1981	—	—	210	21.2

**TABLE 17**  
**EMERGENCY FLYING RATION**  
**1978/79 PROGRAM**

**PERCENT ENERGY DISTRIBUTION**

PACK SELECTED	FAT	PROTEIN	CHO	TOTAL ENERGY kJ
A	32.3	12.7	55.0	12500
B	31.1	12.7	56.1	12400

**TABLE 18**  
**EMERGENCY FLYING RATION**  
**1978/79 PROGRAM**

**VITAMIN RETENTION IN STORAGE**

Component	Initial	THIAMIN			ASCORBIC ACID		
		2 yr @ 37°C	% Retained	Initial	2 yr @ 37°C	% Retained	
Chocolate	5.705	1.174	21	21.1	6.2	29	
Soup Cubes	0.112	0.000	0	22.6	1.2	5	
Fruit Candy	—	—	—	158.7	140.6	89	
Coffee	2.467	0.115	5	1041	917	88	
Biscuits	0.767	0.224	29	—	—	—	

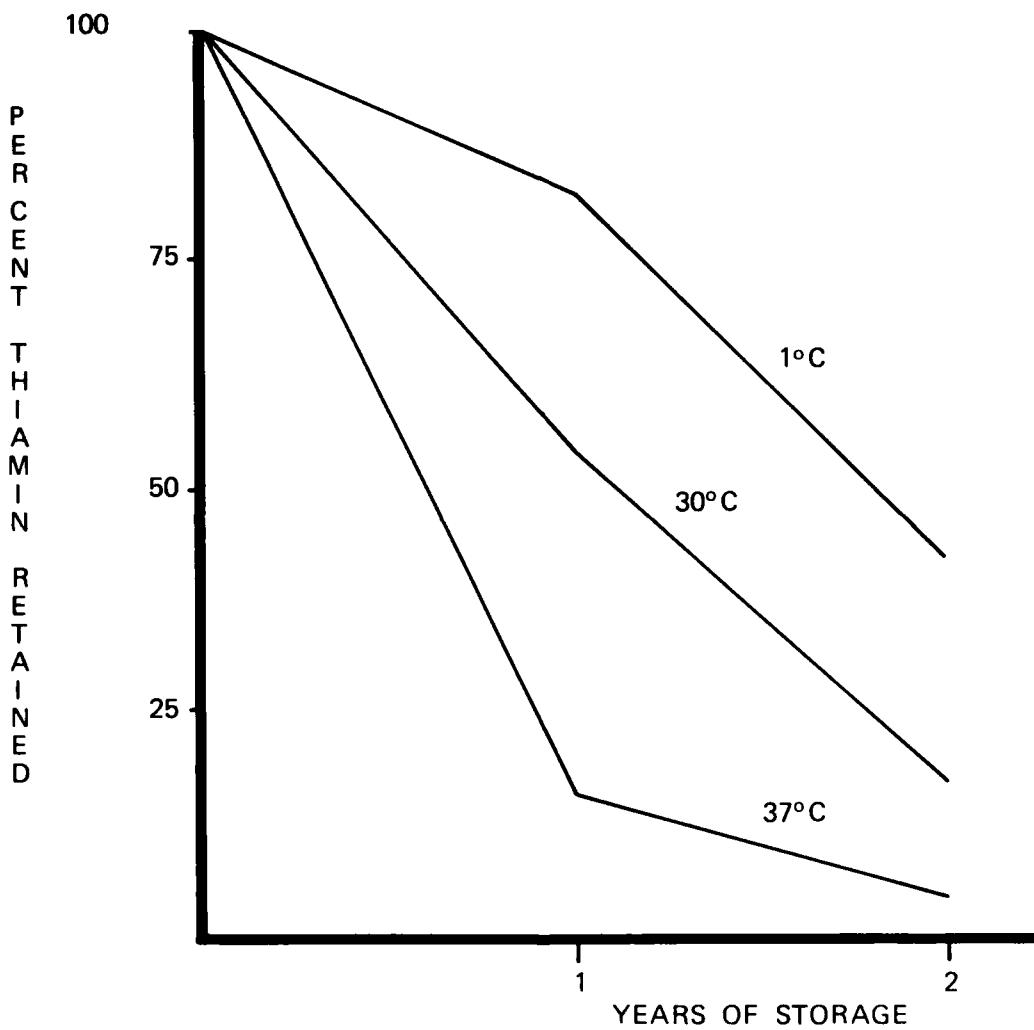


Figure 1. Thiamin loss in coffee during storage at various temperatures.

**COMPLIANCE WITH AUSTRALIAN DEFENCE FORCE FOOD SPECIFICATIONS  
(ADFFS)**

Table 19 summarises the items from each ration which were found to fail at least one ADFFS (16) specification. 25 separate items fail at least one specification. In many cases the failure is in respect of the only specification measured by chemical means.

The instant coffee component of each of the rations fails in respect of the thiamin content, which is generally less than a quarter of the specified amount. Thirteen of the fourteen coffee samples examined also fail in respect of the moisture content, which may be a contributing factor in the low thiamin content. Nine of the ten chocolate rations examined failed by containing only 60% of the ascorbic acid specification. The failures in respect of these two items is of particular concern since they are important fortified items which are common to most rations.

A further three items fail in respect of the ascorbic acid content. If this were to continue, or get worse, there may be a risk that the rations will become deficient in this important vitamin. It indicates that either the goods were deficient at manufacture, or the current storage practice prior to, and after packaging into rations, is deleterious to the goods.

The high frequency of failure in respect of moisture and fat content must be regarded as evidence of inadequate purchasing practice, or non observance of the ADFFS.

**TABLE 19**  
**ITEMS FAILING TO COMPLY WITH ADFFS**

ITEM	SPECIFICATION	REQUIREMENT	VALUES FOUND	PROPORTION FAILING
<b>CR10M</b>				
Spaghetti & Ground Meat	Moisture	< 75%	75.14	1/4
Unsweetened Condensed Milk	Ascorbic Acid	> 660 mg/kg	643, 631, 563, 558, 420	5/6
Butter Concentrate	Moisture	< 0.3%	0.42, 0.37, 0.4, 0.37, 0.5, 0.41, 0.44, 0.38	8/8
Vegemite (Vegetable Extract)	Total Solids	> 63%	58.65, 61.66, 61.94	3/8
Instant Coffee	Thiamin	> 211 mg/kg	35.4, 38.8, 36.4, 36.4, 38.8, 36.4, 36.4	7/7
	Moisture	< 4%	5.76, 5.64, 5.2, 5.49	4/7
Beef & Vegetable Curry	Moisture	< 73%	74.85, 73.47, 73.86	3/8
Luncheon Meat Type II	Fat	< 10%	11.31, 10.64, 11.74, 11.08	4/4
<b>CR1M</b>				
Cereal Block	Moisture	< 6%	6.37	1/1
Survival Biscuit	Moisture	2.5 to 4%	6.68	1/1
Shortbread Biscuit	Moisture	< 4%	6.01	1/1
Chocolate Ration	Ascorbic Acid	> 220 mg/kg	146.9	1/1
	Moisture	< 4%	4.23	1/1
Butter Concentrate	Moisture	< 0.3%	0.32	1/1
Luncheon Meat Type II	Fat	< 10%	13.5	1/1
Sweetened Condensed Milk	Fat	> 9%	5.59%	1/1
Instant Coffee	Moisture	< 4%	5.37	1/1
	Thiamin	> 211 mg/kg	18.63	1/1
Beef & Vegetables	Fat	< 8%	13.01	1/1
Curry Powder	Ash	< 12%	14.93%	1/1

TABLE 19 (Cont)

ITEM	SPECIFICATION	REQUIREMENT	VALUES FOUND	PROPORTION FAILING
<b>CR1M (Cont)</b>				
Beef & Gravy	Fat	< 12%	17.12	1/1
Sausages & Vegetables	Fat	< 5%	9.61	1/1
Beef & Egg	Fat	< 16%	19.3	1/1
Corned Beef	Salt	< 3%	3.35	1/1
<b>PRPNG</b>				
Survival Biscuit	Moisture	2.5 to 4%	7.87, 5.51, 4.14	3/4
Precooked Rice	Ascorbic Acid	> 220 mg/kg	65, 68.4, 48.2	3/4
Chocolate Ration	Ascorbic Acid	> 220 mg/kg	184.7, 68.4, 196, 189.5	4/4
Instant Coffee	Moisture	< 4%	4.84, 6.78, 5.98, 5.46	4/4
	Thiamin	> 211 mg/kg	59.7, 53.7, 56.7, 62.7	4/4
Butter Concentrate	Salt	< 3%	3.02, 3.18	2/2
	Moisture	< 0.3%	0.89, 0.95	2/2
<b>PRIM</b>				
Shortbread Biscuit	Moisture	< 4%	4.36, 5.34	2/3
Jam Cookies	Moisture	< 7%	7.5, 7.54	2/3
Freeze Dried Rice	Moisture	< 2%	5.3	1/3
Instant Skim Milk	Moisture	< 4%	6.32, 4.13, 5.36	3/3
Chocolate	Moisture	< 4%	4.14, 4.85	2/3
	Ascorbic Acid	> 220 mg/kg	152, 187.6, 115.6	3/3
Instant Coffee	Moisture	< 4%	5.28, 4.48	2/3
	Thiamin	> 211 mg/kg	0.8, 16.3, 8.0	3/3
Fruit Drink Powders	Ascorbic Acid	> 0.2%	0.152, 0.172, 0.092	3/3
<b>EFR</b>				
Cereal Block	Moisture	< 6%	6.31	1/2
Chocolate	Ascorbic Acid	> 220 mg/kg	141	1/2
Instant Skim Milk	Moisture	< 4%	5.27	2/2
Coffee	Moisture	< 4%	7.33, 8.85	2/2
	Thiamin	> 211 mg/kg	24.7, 24.7	2/2
Beef Block	Moisture	7 to 11% db	4.78, 4.78	2/2

## CONCLUSION

The energy content of each of the ration packs is adequate for the intended operational use. The protein content of Combat Ration 10 Man and Patrol Ration One Man is excessive and will lead to demands for additional water to metabolise the excess protein. The excessive protein content of Patrol Ration One Man is a matter of concern and a new range of menus which correct this problem are being trialled. Each of the rations contain a large surplus of the vitamins, ascorbic acid and thiamin; which is intended to offset the losses of these vitamins during storage. The salt content would be considered excessive by civil nutritional authorities, however, the surplus is provided to guard against the effect of sweating during strenuous activity in tropical climates. This report makes no adjustment for user preferences. It is known that some items are swapped or rejected which will reduce intake of some nutrients (14).

The microbiological status of the rations examined meets the requirements of the specifications (16). Two year storage trial samples indicate that the microbial population of freeze dried products decline during storage.

The vitamin content of EFR components vary excessively and make study of the storage properties difficult. The products examined are also common to other rations and therefore, wide variations can be expected in the initial vitamin content of most of the rations. This feature is compounded by the failure of some components to meet the minimum specification for vitamins. The net result is that, although the rations examined contained an excess of vitamins, it would be unlikely that all rations contained sufficient vitamins after two years storage for operational use.

Studies of the storage properties of vitamins in the fortified components of the EFR suggest that most rations should have a life of at least two years and possibly longer. However, to be certain of any extended storage life better quality control measures will be necessary during procurement. Further studies are being undertaken to define the life of the fortified components, which meet specifications.

It was previously reported (9) that 19 separate items failed specifications, compared with 25 items in this program. These figures suggest that quality control during procurement is not as strict, or that manufacturers are increasingly unwilling to manufacture to specifications. There are isolated cases of improvement; such as instant coffee which only fails in respect of moisture and thiamin, while previously it also failed to meet the ascorbic acid specification.

## ACKNOWLEDGEMENTS

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**APPENDIX 1**  
**COMBAT RATION TEN MAN**

Supplementary Items	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	ENERGY BOMB kJ/100g
<b>TYPE A</b>											
Beef and Gravy	430	68.09	10.94	2.73	18.06	0.18	1.81	0.020	2.7	715	950
Beef and Gravy	427	67.01	9.72	2.13	19.21	1.93	1.28	0.020	2.5	717	950
Green Peas	447	78.94	0.74	1.17	4.64	14.51	0.68	0.152	2.3	338	440
Green Peas	448	79.76	0.75	1.14	4.41	13.94	0.65	0.160	1.0	326	390
Beef and Gravy	438	67.29	10.42	2.14	16.59	3.56	1.80	0.020	2.0	725	830
Beef and Gravy	431	66.87	10.18	2.76	17.90	2.29	1.34	0.027	1.6	718	770
Tomatoes	443	90.42	0.17	1.29	1.13	6.99	0.99	0.067	2.8	137	150
Tomatoes	439	90.97	0.17	1.44	0.88	6.54	1.76	0.061	1.3	126	
Potatoes	462	79.07	0.70	1.28	1.22	17.73	1.02	0.041	4.2	330	370
Potatoes	458	76.20	0.70	1.24	1.35	20.51	1.03	0.041	2.7	377	390
Potatoes	460	76.46	0.68	1.36	1.54	19.96	1.09	0.038	3.3	371	390
Potatoes	457	76.39	0.65	1.22	1.44	20.30	0.92	0.038	1.3	373	390
Spaghetti and Ground Meat	430	73.06	7.18	2.74	11.27	5.75	1.64	0.034	2.1	549	610
Spaghetti and Ground Meat	430	75.14	5.93	2.42	11.37	5.14	1.72	0.034	1.9	495	560
Spaghetti and Ground Meat	448	72.68	6.36	2.28	10.54	8.14	1.75	0.052	4.0	545	660
Spaghetti and Ground Meat	448	71.98	6.64	2.17	9.49	9.72	1.81	0.051	1.8	563	670
Fruit Pudding	404	25.55	16.27	1.39	4.22	52.57	0.24	0.049	6.0	1515	1650
Fruit Pudding	401	25.76	15.01	1.47	4.57	53.19	0.24	0.049	6.4	1484	1630
Pork and Cereal	340	64.64	15.57	2.36	15.69	1.74	1.57	0.305	0.5	871	950
Pork and Cereal	323	62.19	17.89	2.37	15.30	2.25	1.42	0.307	1.2	958	1090
Fruit Pudding	463	26.00	14.30	1.51	4.38	53.81	0.25	0.032	8.4	1465	1550
Fruit Pudding	473	25.58	15.41	1.41	4.46	53.14	0.25	0.042	8.3	1496	1600
Unsweetened Cond. Milk	397	70.85	8.38	1.85	8.11	10.81	0.44	0.042	64.3	621	680
Raspberry Jam	244	29.56	ND	0.15	0.45	69.84	NS	NS	36.8	1125	1150
Butter Conc.	145	0.42	93.15	2.38	1.79	2.26	2.52	0.015	NS	3513	3660
Tomato Sauce	240	71.47	0.43	3.60	1.78	22.72	2.89	0.092	39.5	410	400
Unsweetened Cond. Milk	396	70.71	8.94	1.77	8.77	9.81	0.44	0.042	63.1	637	700
Butter Conc.	146	0.37	93.02	2.38	1.64	2.59	2.23	0.015	NS	3511	3560
Apricot Jam	260	32.83	ND	0.23	0.30	66.64	NS	0.020	36.0	1071	1020
Vegemite	59	34.97	1.11	14.19	27.88	21.85	10.00	17.5	45.1	865	920

APPENDIX 1 (Cont)  
**COMBAT RATION TEN MAN**

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB kJ/100g
<b>TYPE A (Cont)</b>											
Vegemite	57	36.82	0.89	14.71	28.76	18.82	9.96	17.9	45.9	823	1000
Pork and Cereal	411	65.28	14.13	2.26	14.15	4.18	1.56	0.28	0.5	830	910
Pork and Cereal	340	66.09	11.92	2.52	15.06	4.41	1.57	0.29	0.5	768	910
Instant Coffee	31	3.18	1.21	8.47	19.77	67.37	0.08	3.53	1112	1459	1630
Curry Powder	14	5.72	14.63	6.47	12.80	60.38	1.26	0.34	25.3	1725	1980
Instant Coffee	28	2.56	ND	9.22	19.50	68.72	0.08	3.88	1206	1431	1770
Curry Powder	13	6.18	16.10	6.52	13.37	57.83	1.39	0.34	18.7	1748	1900
Beef Noodle Soup Powder	135	3.47	3.59	20.14	12.42	60.38	16.65	0.20	6.0	1310	1500
Salt	86	1.50	ND	98.5	ND	ND	98.50	ND	ND	ND	ND
Sugar	870	ND	ND	100	ND	ND	100	ND	ND	1600	ND
Tea	108	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

ND Not Determined

NS Not Significant

APPENDIX 1 (Cont)  
COMBAT RATION TEN MAN

Supplementary Items	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB kJ/100g
TYPE B	2000	19.51	6.81	8.09	8.96	56.63	ND	ND	ND	1310	
Sweet Corn	450	72.29	0.92	1.10	2.88	22.81	0.71	0.024	2.5	448	510
Sweet Corn	459	72.63	1.35	1.18	3.15	21.69	0.67	0.024	1.6	451	480
Green Peas	454	80.54	0.66	0.95	4.87	12.98	0.59	0.134	0.6	315	360
Instant Coffee	30	5.76	1.20	8.44	19.89	64.71	0.10	3.64	949	1418	1810
Instant Coffee	28	5.64	1.21	9.28	20.76	63.11	0.06	3.64	1100	1407	1840
Tomato Sauce	200	72.88	0.63	3.34	1.29	21.86	2.63	NS	31.6	395	390
Vegemite	44	31.64	1.31	15.35	30.41	21.29	10.59	18.6	112	906	1020
Vegemite	46	32.22	1.42	15.34	30.57	20.45	10.67	18.2	110	899	1000
Butter Conc.	146	0.40	94.79	2.84	1.17	0.80	2.53	NS	NS	3540	3600
Butter Conc.	144	0.37	95.01	2.65	1.27	0.70	2.52	NS	NS	3548	3460
Curry Powder	14	7.08	17.91	10.25	14.46	50.30	5.06	0.258	43.6	1713	1730
Curry Powder	15	7.87	17.92	9.12	14.02	51.07	4.19	0.172	46.2	1719	1800
Tomato Soup Powder	176	2.68	8.84	14.96	3.80	69.72	12.86	0.055	3.2	1507	1530
Blackberry Jam	246	29.75	NS	0.26	0.30	69.69	NS	0.004	35.7	1120	1100
Condensed Milk	404	71.85	8.02	1.82	9.14	9.17	0.44	0.044	56.3	599	690
Condensed Milk	397	71.70	8.42	1.81	8.99	9.08	0.44	0.044	55.8	610	650
Beef Steak and Kidney	454	73.84	8.61	1.94	13.15	2.46	1.46	0.026	1.2	581	600
Beef Steak and Kidney	453	75.09	8.70	2.20	12.41	1.60	1.44	0.024	1.5	558	640
Beef Steak and Kidney	452	71.54	9.96	1.80	14.24	2.46	1.46	0.024	2.7	650	740
Beef Steak and Kidney	449	71.54	10.76	1.99	13.83	1.88	1.54	0.028	2.9	663	760
Beef and Beans	441	68.43	5.28	2.37	11.01	12.91	1.63	0.018	2.5	589	700
Beef and Beans	463	70.52	7.43	2.29	10.75	9.01	1.74	0.021	3.8	602	670
Beef and Beans	450	68.90	5.86	2.20	11.77	11.27	1.64	0.021	6.7	597	690
Beef and Beans	457	70.15	5.81	2.61	10.97	10.46	1.84	0.014	4.9	569	700
Luncheon Meat Type 1	335	69.54	10.80	3.73	14.07	1.86	2.79	0.066	14.7	669	780
Luncheon Meat Type 1	336	69.29	12.13	3.67	14.10	0.81	2.54	0.072	10.6	701	680
Luncheon Meat Type 1	341	68.35	10.76	3.93	14.00	2.96	2.55	0.074	14.2	683	650
Luncheon Meat Type 1	340	70.01	10.16	3.95	14.83	1.05	2.52	0.073	13.9	645	660
Fruit Salad	458	80.97	NS	0.19	0.43	18.41	NS	0.6	302	330	
Fruit Salad	457	79.70	NS	0.22	0.28	19.80	NS	0.5	322	360	

APPENDIX 1 (Cont)  
COMBAT RATION TEN MAN

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CH <sub>10</sub> %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB kJ/100g
<b>TYPE B (Cont)</b>											
Fruit Salad	458	79.91	NS	0.24	0.37	19.48	NS	NS	0.6	318	330
Fruit Salad	459	79.32	NS	0.24	0.40	20.04	NS	NS	0.7	327	370
Potatoes	458	75.74	0.38	1.28	1.32	21.28	0.89	0.037	3.3	377	430
Potatoes	471	76.85	0.41	1.17	1.66	19.91	0.87	0.044	3.8	362	400
Potatoes	461	78.46	0.46	1.38	1.60	18.10	0.95	0.043	2.6	334	390
Potatoes	457	78.80	0.39	1.08	1.44	18.29	1.07	0.041	3.3	332	370
Tea	107	ND	ND	100	ND	ND	ND	ND	ND	ND	ND
Sugar	870	ND	ND	ND	ND	100	ND	ND	ND	1600	ND
Salt	86	1.40	ND	98.50	ND	ND	98.5	ND	ND	ND	ND

ND Not Determined

NS Not Significant

APPENDIX 1 (Cont)  
COMBAT RATION TEN MAN

Supplementary Items	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB kJ/100g
TYPE C	2000	19.51	6.81	8.09	8.96	56.63	ND	ND	ND	1310	310
Sliced Peaches	434	81.85	0.31	0.27	0.41	17.16	0.004	NS	0.8	293	290
Sliced Peaches	441	82.35	0.29	0.29	0.42	16.65	0.003	NS	1.2	284	290
Whole Baby Carrots	439	92.90	0.62	0.98	0.55	4.95	0.856	0.017	4.0	111	110
Sliced Green Beans	446	92.96	0.32	1.20	0.94	4.58	0.862	0.016	1.3	101	110
Beef and Tomato Puree	447	71.40	7.91	1.87	11.81	7.01	1.721	0.027	5.1	606	750
Beef and Tomato Puree	458	72.06	6.98	2.35	12.78	5.83	1.679	0.018	5.7	569	680
Whole Potatoes	465	78.41	0.41	1.03	1.54	18.61	0.657	0.049	2.4	339	370
Whole Potatoes	467	79.72	0.38	1.18	1.88	16.84	0.696	0.049	3.5	315	330
Beef and Veg Curry	465	70.83	7.01	2.53	9.81	9.82	0.736	0.053	3.1	583	700
Beef and Veg Curry	452	72.26	6.49	2.60	9.91	8.74	1.751	0.052	4.0	548	690
Corned Beef Loaf	337	60.56	15.73	2.43	22.67	NS	1.899	0.035	0.7	945	1050
Corned Beef Loaf	339	60.11	15.53	2.46	22.98	NS	1.915	0.036	1.0	948	1040
Whole Baby Carrots	456	92.85	1.12	0.55	0.55	4.93	0.730	0.017	2.6	130	100
Whole Potatoes	460	80.65	0.41	1.11	1.54	16.29	1.069	0.037	7.0	302	300
Whole Potatoes	464	77.70	0.78	1.25	1.88	18.39	1.154	0.044	5.0	355	370
Sliced Peaches	425	81.94	0.29	0.41	0.42	16.94	0.004	NS	0.7	289	270
Sliced Peaches	425	82.37	0.38	0.40	0.46	16.39	0.004	NS	0.5	284	270
Sliced Green Beans	440	91.98	0.40	1.35	0.94	5.33	1.222	0.017	1.2	116	130
Beef and Veg Curry	465	72.46	7.98	2.68	9.81	7.07	1.806	0.051	3.7	575	540
Beef and Veg Curry	453	70.70	7.75	2.80	10.85	7.90	1.947	0.053	4.7	598	530
Beef and Tomato Puree	461	71.39	11.37	2.36	9.94	4.94	1.575	0.018	3.1	669	680
Beef and Tomato Puree	459	72.78	7.85	2.29	10.53	6.55	1.828	0.018	5.8	574	620
Corned Beef Loaf	336	63.36	16.02	2.45	10.19	7.98	1.965	0.037	1.1	894	1090
Corned Beef Loaf	334	62.43	12.44	2.50	9.79	12.84	1.940	0.036	0.7	832	960
Tomato Soup Powder	165	2.47	8.84	15.11	3.80	69.78	12.859	0.055	4.8	1508	1500
Blackberry Jam	257	29.79	NS	0.19	0.30	69.72	0.007	0.004	35.7	1121	1210
Apricot Jam	255	31.24	NS	0.29	0.37	68.10	0.007	0.008	43.0	1096	1170
Cond. Milk	399	70.93	8.02	1.83	9.01	10.21	0.442	0.043	56.3	613	710
Cond. Milk	402	70.93	8.42	1.83	8.94	9.88	0.444	0.041	55.8	622	720
Tomato Sauce	192	73.35	0.89	3.40	1.76	20.60	2.744	0.082	25.7	392	440

APPENDIX 1 (Cont)  
COMBAT RATION TEN MAN

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	CALC. kJ/100g	BOMB kJ/100g
TYPE C (Cont)											
Strawberry Jam	248	28.91	NS	0.13	0.31	70.65	0.011	0.008	42.0	1136	1330
Strawberry Jam	255	28.91	NS	0.13	0.24	70.72	0.011	0.008	41.8	1136	1230
Cond. Milk	410	70.72	8.08	1.87	9.33	10.00	0.450	0.044	64.1	618	660
Cond. Milk	410	70.73	7.78	1.85	8.94	10.70	0.451	0.048	66.2	611	700
Conc. Butter	140	0.50	94.91	3.05	1.54	NS	2.698	0.031	NS	3538	3780
Conc. Butter	135	0.41	94.11	3.97	1.51	NS	2.540	0.024	NS	3508	3730
Vegemite	46	41.35	1.40	14.69	31.07	11.49	10.369	16.5	50.1	764	950
Vegemite	45	37.04	0.99	14.71	29.60	17.66	10.289	15.8	38.3	822	1000
Instant Coffee	30	3.19	0.43	8.65	20.71	67.02	0.069	3.88	1187	1440	1750
Instant Coffee	28	5.20	0.49	8.87	20.44	65.00	0.072	3.64	1065	1406	1680
Curry Powder	15	5.95	16.67	6.87	13.19	57.32	1.304	0.172	18.3	1758	2120
Chicken Noodle Soup	127	3.40	3.34	23.78	11.42	58.06	19.109	0.196	3.9	1247	1540
Salt	86	1.50	ND	98.50	ND	98.500	ND	ND	ND	ND	ND
Sugar	870	ND	ND	ND	100	ND	ND	ND	ND	1600	ND
Tea	107	ND	ND	ND	100	ND	ND	ND	ND	1600	ND

ND Not Determined

NS Not Significant

APPENDIX 1 (Cont)

COMBAT RATION TEN MAN

Supplementary Items	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB kJ/100g
<b>TYPE D</b>	2000	19.52	6.81	8.09	8.96	56.62	ND	ND	ND	1310	
Whole Potatoes	457	78.70	0.27	1.30	1.35	18.38	0.970	0.061	3.7	327	350
Whole Potatoes	452	82.62	0.07	1.36	1.36	14.59	0.772	0.051	4.0	259	300
Fruit Pudding	389	25.81	14.54	1.37	4.38	53.90	0.257	0.034	10.3	1475	1590
Fruit Pudding	389	25.76	15.25	1.42	4.36	53.21	0.261	0.041	6.4	1490	1570
Red Kidney Beans	378	72.90	0.87	2.34	6.75	17.14	1.698	0.072	NS	421	530
Beef Steak and Kidney	451	74.54	8.54	2.26	14.21	0.45	1.381	0.068	NS	565	738
Beef Steak and Kidney	447	70.96	7.41	2.06	13.08	6.49	1.579	0.068	NS	600	670
Beef and Vegetable Curry	466	74.85	7.55	2.30	8.64	6.66	1.422	0.045	NS	533	570
Beef and Vegetable Curry	457	73.47	5.68	2.23	9.86	8.76	1.430	0.038	NS	518	630
Luncheon Meat Type 2	337	66.55	11.31	2.24	12.93	6.97	1.580	0.052	NS	750	870
Luncheon Meat Type 2	337	65.89	10.64	2.21	12.97	8.29	1.586	0.048	NS	747	880
Sliced Green Beans	443	91.66	.30	1.52	0.84	5.68	0.915	0.017	1.3	116	140
Whole Potatoes	471	79.18	.26	1.04	1.70	17.82	0.918	0.051	4.8	324	350
Whole Potatoes	470	75.74	.34	1.36	1.72	20.84	0.744	0.050	3.6	375	430
Fruit Pudding	388	25.64	14.22	1.38	4.24	54.52	0.265	0.050	6.7	1471	1490
Fruit Pudding	395	26.02	13.54	1.34	4.21	54.89	0.256	0.057	5.0	1451	1730
Red Kidney Beans	477	71.56	7.00	2.37	6.86	12.21	1.674	0.081	NS	571	490
Beef Steak and Kidney	454	77.41	7.53	2.05	11.49	1.52	1.603	0.067	NS	498	550
Beef Steak and Kidney	449	77.24	8.06	2.16	10.53	2.01	1.520	0.067	NS	509	580
Beef and Vegetables	466	71.88	6.63	2.15	10.19	9.15	1.325	0.037	3.3	565	670
Beef and Vegetable Curry	457	73.86	5.82	2.15	9.79	8.38	1.449	0.038	3.4	516	590
Luncheon Meat Type 2	337	66.70	11.74	2.21	12.43	6.92	1.333	0.042	NS	756	850
Luncheon Meat Type 2	337	67.49	11.08	2.13	12.12	7.18	1.333	0.049	1.3	731	840
Sliced Green Beans	445	92.27	0.31	1.69	1.06	4.67	0.811	0.016	1.4	104	130
Condensed Milk	410	69.81	8.26	1.79	8.60	11.54	0.455	0.048	67.8	636	720
Condensed Milk	412	69.17	7.31	1.81	8.94	12.77	0.456	0.043	42.0	627	720
Raspberry Jam	261	29.98	NS	0.19	0.25	69.58	0.009	0.008	18.9	1118	1110
Tomato Sauce	232	73.76	0.27	3.33	1.38	21.26	2.700	0.093	17.0	374	380
Blackberry Jam	253	30.26	NS	0.19	0.31	69.24	0.007	0.008	49.9	1113	1113

APPENDIX 1 (Cont)  
COMBAT RATION TEN MAN

TYPE D (Cont)	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	ENERGY BOMB kJ/100g
Concentrated Butter	152	0.44	95.27	2.94	1.35	NS	2.694	0.031	NS	3548	3480
Concentrated Butter	154	0.38	95.11	2.93	1.58	NS	2.538	0.031	NS	3546	3550
Curry Powder	14	4.36	15.19	6.00	13.19	61.26	1.162	0.344	18.4	1766	2060
Vegemite	55	38.34	1.06	14.90	28.28	17.42	10.617	16.5	44.9	799	950
Vegemite	52	38.06	0.98	14.91	28.76	17.29	10.171	16.5	38.9	802	870
Pea and Ham Soup Powder	148	3.60	7.17	8.00	18.99	62.24	9.189	0.533	13.1	1584	1780
Coffee Powder	28	5.49	1.21	8.15	20.24	64.91	0.072	3.64	1080	1427	1780
Salt	86	1.50	ND	98.50	ND	ND	98.500	ND	ND	ND	ND
Sugar	869	ND	ND	ND	ND	100	ND	ND	ND	1600	ND
Tea	106	ND	ND	ND	100	ND	ND	ND	ND	ND	ND

ND Not Determined

NS Not Significant

**APPENDIX 2**  
**COMBAT RATION ONE MAN**

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB
Cereal Block	61.4	6.37	20.61	1.34	9.35	62.33	0.78	0.345	1.3	1919	2060
Survival Biscuit	45.2	6.68	13.52	2.16	9.03	68.61	1.77	0.171	1.0	1752	1870
Shortbread Biscuit	87.9	6.01	20.73	1.53	5.65	66.08	1.53	0.119	3.2	1920	2020
Process Cheese	49.1	44.60	26.48	6.72	20.88	NS	3.71	0.008	1.3	1330	1420
Chocolate Ration	50.6	4.23	24.22	1.91	8.92	60.72	0.47	5.938	14.7	2019	2200
Chewing Gum	6.7	3.62	10.11	ND	ND	86.27	ND	ND	ND	1754	ND
Candy Butterscotch	49.3	4.76	.72	1.07	0.43	91.02	1.08	NS	4.0	1564	1590
Butter Concentrate	29.1	0.32	95.00	2.79	1.89	NS	2.68	NS	NS	3547	3530
Sweetened Condensed Milk	72.5	2.58	5.59	1.93	9.81	80.09	0.69	0.097	3.2	1655	1910
Instant Coffee	6.7	5.37	.71	7.65	20.52	65.75	0.11	1.863	1125.5	1427	1820
Sugar	83.0	0.13	ND	ND	ND	99.87	ND	ND	ND	1598	ND
Tea Bags	3.8	ND	ND	ND	ND	100	ND	ND	ND	1600	ND
Salt	7.2	0.62	ND	ND	ND	99.38	ND	ND	ND	1590	ND
Fruit Drink Powder	14.5	1.03	3.93	0.83	0.54	93.67	0.02	NS	182.46	1653	1650
<b>34</b>											
<b>TYPE A</b>											
Ham and Eggs	112.7	66.13	17.1	2.59	14.98	NS	2.20	0.108	0.5	875	990
Plum Jam	26.7	28.20	0.49	0.41	0.22	70.68	NS	NS	39.9	1153	1220
Beef and Vegetable	230.0	62.80	13.01	1.88	12.95	9.36	1.48	0.036	3.6	851	1050
Curry Powder	3.5	10.30	17.24	14.93	13.76	43.77	5.30	0.512	NS	1572	2030
Freeze Dried Rice	56.1	1.85	1.12	0.66	7.57	88.80	0.28	NS	NS	1591	1930
Peaches	143.0	79.96	0.43	0.57	0.57	18.47	0.01	NS	0.6	321	360
<b>TYPE B</b>											
Curry Powder	3.5	10.30	17.24	14.93	13.76	43.77	5.30	0.512	NS	1572	2030
FD Rice	56.1	1.85	1.12	0.66	7.57	88.80	0.280	NS	1591	1930	1930
Peaches	148.0	79.96	0.43	0.57	0.57	18.47	0.01	NS	0.6	321	360
Pork and Beans	114.6	72.92	5.35	2.85	9.82	9.06	2.56	0.163	10.0	510	640
Raspberry Jam	26.6	28.83	0.63	0.03	0.48	70.03	0.02	0.031	38.9	1152	2000
Corned Beef Hash	224.4	75.16	7.33	2.36	6.87	8.28	2.00	0.028	12.3	520	550

**APPENDIX 2 (Cont)**  
**COMBAT RATION ONE MAN**

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g
<b>TYPE C</b>										
Curry Powder	3.54	10.30	17.24	14.93	13.76	43.77	5.30	0.512	NS	1572
FD Rice	56.10	1.85	1.12	0.66	7.57	88.80	0.28	NS	NS	2030
Luncheon Meat Type 2	116.34	64.94	13.50	2.24	11.32	8.00	2.14	0.017	0.5	1591
Apricot Jam	27.30	27.28	0.41	0.07	0.29	71.95	NS	40.1	40.1	1930
Beef and Gravy	234.18	60.78	17.12	1.97	19.59	0.54	0.91	0.025	1.6	900
Pears	145.11	82.99	0.34	0.22	0.44	16.01	NS	NS	NS	1140
									276	1110
<b>TYPE D</b>										
Potato and Onion Powder	49.66	4.32	7.62	3.74	12.87	71.45	0.75	0.146	7.1	1644
Two Fruits	147.73	79.14	0.38	0.30	0.40	19.78	NS	0.009	0.3	1860
Sausages and Vegetables	116.96	75.04	9.61	2.49	7.69	5.17	1.70	0.027	2.2	360
Blackberry Jam	26.50	28.25	.60	0.68	0.18	70.29	0.005	0.021	42.6	640
Beef Soup Powder	6.60	ND	ND	ND	ND	ND	ND	ND	ND	1160
Luncheon Meat Type 1	220.76	67.50	13.30	3.75	14.29	1.16	3.01	0.061	22.1	ND
									754	ND
<b>TYPE E</b>										
Potato and Onion Powder	49.56	4.32	7.62	3.74	12.87	71.45	0.75	0.146	7.1	1644
Two Fruits	147.73	79.14	0.38	.30	0.40	19.78	NS	0.009	0.3	1860
Beef and Egg	108.11	66.16	19.30	2.12	14.12	NS	1.46	0.027	0.5	337
Peach Jam	26.90	25.81	0.21	0.35	0.39	73.24	NS	58.6	58.6	360
Chicken Soup Powder	6.50	ND	ND	ND	ND	ND	ND	ND	ND	927
Corned Beef	221.30	64.22	20.04	3.34	12.77	NS	3.35	0.038	17.8	1010
									953	1160

ND Not Determined

NS Not Significant

**APPENDIX 3**  
**PATROL RATION PAPUA NEW GUINEA**

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	CALC. kJ/100g	ENERGY CALC. kJ/100g	BOMB kJ/100g
<b>Minor Components:</b>												
Salt	7	ND	ND	100	ND	ND	ND	ND	ND	ND	ND	ND
Sugar	83	ND	ND	100	ND	ND	ND	ND	ND	1600	ND	ND
Tea Bags	2	ND	ND	100	ND	ND	ND	ND	ND	ND	ND	ND
<b>TYPE A</b>												
Lunchbox Meat	227	70.72	9.60	3.53	14.8	1.35	2.422	0.089	4.1	628	850	
Ham and Eggs	112	69.73	11.62	2.16	14.2	2.29	1.146	0.145	0.7	708	890	
Survival Biscuits	42	7.87	10.55	2.14	9.1	70.34	1.371	0.137	0.2	1670	2050	
Pre Cooked Rice	250	8.71	0.33	0.35	2.3	88.31	0.067	8.136	6.5	1464	2100	
Potato and Onion	51	4.76	7.29	3.62	13.5	70.83	0.518	0.140	2.6	1632	1010	
Chocolate Ration	51	3.52	24.96	1.90	9.9	59.72	0.314	5.251	18.5	2047	1510	
Condensed Milk	71	24.40	4.75	1.82	9.3	59.73	0.428	0.134	1.5	1290	1650	
P.K. Chewing Gum	4	3.12	ND	ND	ND	96.88	ND	ND	ND	1550	1790	
Instant Coffee	7	4.84	1.05	7.23	20.3	66.58	0.048	5.975	732	1449	1790	
<b>TYPE B</b>												
P.K. Chewing Gum	4	3.40	ND	ND	ND	96.60	ND	ND	ND	1546	1880	
Chocolate Ration	50	3.80	25.35	1.69	6.1	63.06	0.051	5.114	6.8	2051	2340	
Pre Cooked Rice	251	10.79	0.68	0.35	6.1	82.08	0.051	10.355	6.8	1442	1650	
Survival Biscuits	43	3.02	12.53	2.57	11.0	70.88	1.520	0.343	3.4	1785	2150	
Cheers	41	1.58	0.31	0.22	0.2	97.69	0.216	NS	155.4	1578	1600	
Butter Concentrate	28	0.89	90.50	3.06	2.0	3.55	3.020	0.186	NS	3439	3930	
Pork and Beans	236	70.61	8.50	3.12	12.8	4.97	2.030	0.168	1.7	612	760	
Tuna in Oil	112	54.39	19.90	1.90	20.8	3.01	1.140	0.172	NS	1138	1470	
Instant Coffee	7	6.78	1.14	6.45	20.3	65.33	.080	5.377	1512.	1433	1750	

APPENDIX 3 (Cont.)  
PATROL RATION PAPUA NEW GUINEA

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	ENERGY BOMB kJ/100g
<b>TYPE C</b>											
P.K. Chewing Gum	4	3.25	ND	ND	96.75	ND	ND	ND	ND	1548	1760
Steak and Eggs	110	72.41	9.93	2.34	13.4	1.92	1.660	0.057	NS	626	770
Pre Cooked Rice	251	11.24	0.37	0.32	6.0	82.07	0.050	13.166	4.8	1429	1550
Cheers	41	3.63	0.22	0.10	0.2	95.85	0.219	NS	146.8	1545	1660
Survival Biscuits	42	5.51	12.86	2.21	10.4	69.02	1.480	0.273	0.3	1757	1980
Chocolate	51	3.57	26.09	1.68	9.1	59.56	0.320	4.831	19.60	2073	2290
Corned Beef	227	57.10	17.64	2.50	22.2	0.56	1.980	0.009	NS	1039	1220
Butter Concentrate	28	.95	90.66	3.33	2.1	2.96	3.180	NS	NS	3437	3780
Instant Coffee	7	5.98	1.74	4.76	19.9	67.62	0.440	5.676	1105.	1485	1720
<b>TYPE D</b>											
Survival Biscuits	42	4.14	12.71	2.29	10.59	70.27	1.500	0.295	0.8	1775	2160
Chocolate	50	3.74	24.80	1.60	9.17	60.69	0.329	4.805	19.0	2045	2310
Pre Cooked Rice	252	7.42	0.61	0.25	5.22	86.50	0.060	13.905	37.0	1495	1570
Condensed Milk	71	24.74	7.92	1.81	9.54	55.99	0.431	0.111	1.0	1351	1540
Potato and Onion	50	4.46	6.29	3.48	13.73	72.04	0.490	0.162	1.3	1619	1910
P.K. Chewing Gum	4	3.62	ND	ND	96.38	ND	ND	ND	ND	1542	1880
Luncheon Meat	114	65.79	13.00	1.99	12.69	6.53	1.900	0.034	NS	801	860
Beef and Gravy	228	67.69	9.62	2.11	14.77	5.81	1.660	0.036	NS	700	880
Instant Coffee	7	5.46	0.73	5.86	19.34	68.61	0.070	6.273	1109	1454	1840

ND Not Determined

NS Not Significant

**APPENDIX 4**  
**PATROL RATION ONE MAN**

		WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB
Salt	Salt	7	ND	ND	100	ND	ND	170	ND	ND	ND	ND
<b>TYPE A</b>												
Shortbread	80	3.14	20.84	1.52	5.83	68.67	1.24	0.12	4.5	1969	2280	
Jam Cookies	82	6.92	17.27	1.14	4.13	70.54	0.43	0.07	1.0	1838	2000	
Cheddar Cheese	41	42.01	27.79	6.47	21.74	1.99	3.46	0.02	1.1	1430	1580	
F.D. Rice	56	5.30	0.71	0.48	7.56	85.95	0.15	NS	NS	1530	1640	
Beef and Green Beans	111	2.08	20.88	6.27	57.38	13.39	3.45	0.21	20.7	1962	2500	
Lamb and Veg. Curry	113	2.06	23.08	4.20	51.29	19.37	1.24	NS	14.6	2036	2520	
Instant Milk	28	6.32	1.07	8.95	35.82	47.84	1.76	0.32	NS	1414	1730	
Chocolate	51	4.14	26.70	1.94	8.95	58.27	0.33	7.18	15.3	2072	2000	
Sugar	85	ND	ND	ND	ND	100	ND	ND	ND	ND	ND	
Instant Coffee	7	5.28	2.60	8.48	20.05	63.59	0.05	0.08	1017.5	1454	920	
Orange Powder	14	1.68	5.65	4.63	0.31	87.73	NS	NS	151.6	1618	1550	
Chewing Gum	4	4.69	ND	ND	ND	95.31	ND	ND	ND	ND	ND	
<b>TYPE B</b>												
Shortbread Biscuits	85	4.36	21.17	1.34	5.75	67.38	1.11	0.13	2.9	1959	2090	
Jam Cookies	84	7.50	18.26	1.05	3.97	69.22	0.56	0.12	1.8	1851	1980	
Cheddar Cheese	41	41.88	27.49	6.86	20.94	283	3.48	0.03	NS	1418	ND	
Chocolate	50	4.85	25.82	1.98	8.92	58.43	0.33	9.46	18.8	2042	1350	
F.D. Rice	55	1.35	0.74	0.50	7.67	89.74	0.28	NS	NS	1594	1820	
Roast Pork and Gravy	111	1.07	23.54	5.35	65.62	4.42	2.42	0.90	19.4	2057	2480	
Beef and Onions	112	1.66	11.18	6.68	59.10	21.38	3.67	0.20	13.8	1760	2280	
Lemon Powder	14	0.55	2.95	0.70	0.12	95.68	NS	NS	172.2	1642	ND	
Sugar	85	ND	ND	ND	ND	100	ND	ND	ND	ND	ND	
Instant Coffee	7	4.48	0.86	7.62	19.36	67.68	0.03	1.63	1025	1444	ND	
Instant Milk	29	4.13	1.03	7.55	36.84	50.45	1.82	0.40	NS	1472	1810	

APPENDIX 4 (Cont)  
PATROL RATION ONE MAN

TYPE C	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g	BOMB kJ/100g
Shortbread Biscuits	85	5.34	21.32	1.32	5.8	66.22	1.09	0.14	3.0	194.7	2200
Jam Cookies	86	7.54	17.58	1.03	3.91	69.94	0.45	0.09	0.9	1836	2010
Cheddar Cheese	41	41.87	27.03	6.87	21.4	2.83	3.49	0.03	0.9	1409	ND
F.D. Rice	56	.6	.81	.59	.752	90.48	0.29	NS	NS	1605	1830
Instant Milk	29	5.36	.42	7.86	35.68	50.68	1.86	0.37	NS	1433	1800
Instant Coffee	7	3.75	1.8	7.02	19.84	67.59	0.06	0.80	1412	1485	ND
Lime Powder	14	1.82	1.95	.56	.32	96.4	NS	NS	92.4	1603	ND
Chocolate	52	3.44	27.76	1.9	8.99	57.91	0.33	4.93	11.6	2107	2180
Spaghetti and Meat	111	2.48	10.23	4.92	33.32	49.05	2.66	0.16	5.1	1730	2090
Savoury Steak Fingers	113	1.07	10.54	8.73	60.49	19.17	5.16	0.18	24.2	1725	2080
Sugar	85	ND	ND	ND	ND	100	ND	ND	ND	1600	ND

ND Not Determined      NS Not Significant

APPENDIX 5

MICROBIOLOGICAL MONITORING OF FREEZE DRIED MEALS,  
POTATO & ONION POWDER

NO. OF SAMPLES	SAMPLING POINT	NO. OF REJECT BATCHES	STANDARD PLATE COUNT PER g	COLIFORMS PER g	E. COLI TYPE 1 PER g	YEASTS PER g	MOULDS PER g	COAGULASE POSITIVE STAPH/g	SAFONELLA IN 25 g
165	Beef & Green Beans	NIL	10 - 3,600	<1	<1	<1 - 4	<1 - 5	<3 -	23
164	Beef & Onions	NIL	<10 - 1,100	<1	<1	<1 - 4	<1 - 2	<3 -	4
97	Lamb & Vegetable Curry	NIL	70 - 15,000	<1	<1	<1	<1 - 7	<3 -	Absent
337	Potato & Onion Powder	NIL	1,200 - 320,000	<1 - 10	<1	<1 - 2	<1 - 70	<3 -	3
147	Rice	NIL	<10 - 117,800	<1	<1	<1	<1 - 15	<3 -	Absent
212	Roast Pork & Gravy	2*	30 - 44,000	<1 - 21	<1 - 18	<1 - 480	<1 - 1	<3 -	93
134	Savoury Steak Fingers	NIL	10 - 6,000	<1 - 4	<1	<1	<1 - 3	<3 -	Absent
204	Spaghetti with Meat Sauce	#	<10 - 3,000	<1	<1	<1 - 2	<1 - 5	<3 - 1,100	Absent

\* 1 SPC, Coliforms & E. Coli  
1 SPC & Coliforms

# all for Coagulase Positive Staphylococcus

**APPENDIX 6**  
**EMERGENCY FLYING RATION**

	WEIGHT g	MOISTURE %	FAT %	ASH %	PROTEIN %	CHO %	SALT %	THIAMIN mg/100g	ASCORBIC ACID mg/100g	ENERGY CALC. kJ/100g
<b>SET A</b>										
Cereal Block	114	6.31	21.05	1.48	10.44	60.72	0.707	0.189	1.7	1928
Chocolate	171	3.74	25.44	1.76	9.20	59.86	0.41	5.705	14.1	2055
Butterscotch	72	3.59	4.61	0.90	0.38	90.52	0.684	NS	1.7	1625
Biscuits	85	3.15	13.71	2.23	9.15	71.76	1.562	0.767	1.2	2020
Soup Cubes	26	2.92	11.7	61.61	14.87	8.90	56.67	0.066	22.6	828
Fruit Candy	85	3.07	0.63	0.24	0.09	95.97	0.221	NS	140	1570
Processed Cheese	47	44.59	27.93	6.32	19.78	1.38	3.02	0.038	.3	1392
Milk Powder	6	5.27	0.84	8.12	36.11	49.66	1.81	0.350	1.6	1440
Soluble Coffee	11	8.85	2.84	8.66	20.25	59.40	0.104	2.467	847	1400
Beef Block	56	4.00	16.38	4.29	71.43	3.90	2.86	.057	NS	1883
Salt	7	ND	ND	100	ND	100	ND	ND	ND	ND
Sugar	34	ND	ND	ND	ND	100	ND	ND	ND	1600
<b>SET B</b>										
Cereal Block	115	5.94	20.47	1.44	9.95	62.20	.706	0.288	2.0	1922
Chocolate	170	3.66	23.77	1.96	9.49	60.82	.225	6.154	21.1	2014
Butterscotch	72	3.11	4.56	0.93	0.23	91.17	.297	NS	0.8	2200
Biscuits	86	3.34	14.24	2.27	8.85	71.30	1.000	0.188	1.6	1710
Soup Cubes	26	3.17	11.53	62.25	13.46	9.59	52.85	0.112	29.0	1950
Fruit Candy	86	2.71	NS	0.27	0.15	96.87	0.039	NS	158.8	690
Processed Cheese	48	43.15	26.25	6.64	20.17	3.79	2.888	0.06	1552	1570
Milk Powder	6	5.27	0.84	8.12	36.11	49.66	1.81	0.36	1.6	1803
Soluble Coffee	11	7.33	1.82	8.27	20.25	62.33	0.087	2.467	1041	ND
Beef Block	56	4.00	16.38	4.29	71.43	3.90	2.86	0.057	NS	ND
Salt	7	ND	ND	100	ND	100	ND	ND	ND	ND
Sugar	34	ND	ND	ND	ND	100	ND	ND	ND	1600

ND Not Determined

NS Not Significant

APPENDIX 7

EMERGENCY FLYING RATION  
MICROBIOLOGICAL RESULTS

NO. of SAMPLES	SAMPLING POINT	STANDARD PLATE COUNT PER g	COLIFORMS PER g	E. COLI TYPE I PER g	YEASTS PER g	MOULDS PER g	COAGULASE POSITIVE STAPH/g	SALMONELLA IN 25 g
2	Beef Block	60- 100	<1	<1	<1	<1	<3	Absent
2	Biscuits	20- 30	<1	<1	<1	<1	<3	Absent
2	Butterscotch	20- 30	<1	<1	<1	<1	<3	Absent
2	Cereal Block	20- 130	<1	<1	<1	<1	<3	Absent
2	Cheese	10- 30	<1	<1	<1	<1	<3	Absent
2	Chocolate	640-9,500	<1	<1	<1	<1	<3	Absent
2	Coffee	10- 30	<1	<1	<1	<1	<3	Absent
2	Milk Powder	180- 200	<1	<1	<1	4-31	<3	Absent
2	Salt	<10- 40	<1	<1	<1	<1	<3	Absent
2	Soup Cubes	<10	<1	<1	<1	<1	<3	Absent
2	Sugar	<10- 10	<1	2-3	<1	<1	<3	Absent

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